



English Abstracts

Containing the spread of the invasive plant *Acacia saligna* in the Judean Mountains National Park

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Extensive knowledge has accumulated on the subject of invasive plant species in Israel in recent years; however, management experience in treating current invasions is scarce, and in many cases has only had partial success. We believe that the absence of a structured plan for decision-making and implementation is one of the main weaknesses that prevents a more efficient and successful treatment of invasive plant species. This paper reviews the project established to contain the spread of *Acacia saligna* in the Judean Mountains National Park and, for the first time, presents a plan for long-term active management to treat invasive plants on a large regional scale. In the current project, the main objective is to protect local natural resources, landscape and heritage from invasion and domination by the invasive plant *A. saligna*. In order to bridge knowledge gaps in the lead-up to active management, the region was mapped to characterize the distribution and density of *A. saligna*. At the same time, a pilot study was conducted to determine the cost and efficacy of different management options and field conditions for implementation. The basis for implementation was that the action plan be practical and feasible. Implementation began in January 2018 and consisted of two stages: cutting down mature trees and treating the stumps in the first year, followed by regular treatment of regenerating shoots, rootstocks and seedlings. The project was monitored and results demonstrated the significant effectiveness of cutting down trees and treating the stumps, for killing the mature trees and regenerating vegetation in the treated plots. To examine the effectiveness of the project in containing the invasive species, monitoring

was conducted on isolated groups of trees in the area that served as an untreated control. Preliminary results demonstrated that in the absence of treatment, *A. saligna* continued to spread, probably due to pine thinning treatment. Regeneration measurements in treated plots compared to control plots indicated that the project was highly effective in containing the spread of the invasive species – the main objective of this project. Collaboration between the bodies that set policy and those that manage open landscapes proved to be a catalyst for achieving the target. The project has demonstrated that an action plan based on ecological knowledge and professional understanding, forms the basis for success in the battle against invasive plants.

Warm maquis, cool forest: Use of thermal imaging to estimate water use in maquis and forest trees

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Among forest types, the Mediterranean maquis is particularly subjected to fluctuations in water availability. Therefore, monitoring the water use patterns of its major tree species is essential for quantifying local and regional water balance. However, traditional measurement methods of tree water use are difficult and labor-intensive at high spatial scales, which could make indirect methods more effective. Transpiration from the leaf surface involves evaporative cooling; therefore, temperature differences between the leaf and its surrounding environment ($\Delta T_{\text{leaf-air}}$) can serve as a reliable proxy for tree water use.

In this study we measured transpiration rate (T_r) both directly, with a gas exchange system, and with infra-red (IR) thermography, to study the relationship between $\Delta T_{\text{leaf-air}}$ and T_r . Controlled experiments were conducted together with measurements in the forest, on five dominant Mediterranean tree species with different leaf shapes (conifers: *Pinus halepensis*; *Cupressus sempervirens*; broadleaf: simple: *Quercus calliprinos*; *Ceratonia siliqua*; compound: *Pistacia lentiscus*). In addition, we computed the leaf energy balance in order to estimate T_r from the thermal images, compared to the direct measurement.

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Our observations show that the use of thermal imaging allows estimation of transpiration-induced changes in leaf temperature across species, and estimation of T_r in a natural setting. We found that conifers were significantly cooler than broadleaves, and that $\Delta T_{\text{leaf-air}}$ depends on transpiration rate and is species-specific.

Vegetative propagation and establishment of summer and autumn-flowering *Eucalyptus* plots, to support apiculture

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The arid summer and autumn in Israel pose an annual challenge of declining natural food sources for local apiaries. *Eucalyptus* trees are planted in Israel for honeybee pasture, some of which bloom in the summer and autumn. However, high variability in blooming traits has been documented. Since most of the *Eucalyptus* trees in Israel are propagated from seeds, we assume that this variability is affected, at least in part, by genetic heterogeneity. To achieve uniformity, we selected trees that were attractive to honeybees and showed outstanding blooming in the desired seasons, and propagated them from cuttings. These included individuals from the following species that grow in Kfar Pines (Israel): *Eucalyptus camaldulensis*, *E. x trabutii*, *E. brachyphylla*, and *E. leucoxylon leucoxylon*. An evaluation of their attractiveness to bees confirmed that the first three were excellent, and they were therefore propagated from cuttings. The last species, despite its high nectar production, did not attract bees. Based on nectar measurements, we estimate that clonal plantations of *E. x trabutii* or *E. brachyphylla* could yield 327 and 526 kg of honey per 0.1 ha, respectively. To assess uniform blooming and the high predicted yield in clonally propagated trees, a clonal plantation was established at the Volcani Center (in Rishon LeZion), in addition to 10 smaller plantations across Israel – from the Arava Valley, through the western Negev,

Hebron Mountains, central Israel, the northern valleys and the Golan Heights.

Developing methodologies for enriching forests with mycorrhizal edible-mushrooms and the analysis of its effect on the growth rate of three pine tree species

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In recent years, the abundance of edible mushrooms in the KKL-JNF forests is decreasing, along with an increase in the number of edible mushroom foragers and aficionados. The major reasons behind the mushroom decline are generally assumed to be climate changes and excessive foraging.

A number of methods were developed for inoculating tree seedlings with different mycorrhizal mushrooms. This symbiotic interaction contributes to the survival of the young trees, while at the same time enriching the forest with highly desirable mushrooms. The main goals of the current study were the establishment of practices for optimal inoculation of forest trees seedlings with edible mycorrhizal mushrooms, while developing suitable agro-technical procedures to facilitate the survival of newly planted trees and promote mushroom fructification.

The mushrooms and trees serving as models for this project were: (1) *Suillus collinitus* – ectomycorrhizal with endemic and acclimatized pine trees – that primarily forms mycorrhizal bonds with *Pinus halepensis*, and can also form mycorrhizal bonds with *P. brutia*, *P. pinea*, and *P. canarensis*; (2) *Lactarius deliciosus*, which establishes mycorrhizal interactions with coniferous trees and notably with pine trees such as *P. halepensis*, *P. brutia*, and *P. pinea*. In the current study, tree seedlings were inoculated with the two mushrooms species in order to determine their effect on subsequent seedling development and survival.

We found that inoculation of *P. halepensis*, *P. brutia* and *P. pinea* with *S. collinitus* elevated seedling growth rate in the greenhouse, with the highest contribution found in the development of *P. halepensis* (180%). Inoculation with *L. deliciosus* led to similar (albeit more moderate) results.

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A molecular analysis of root samples from representative trees in the terra-rossa plot demonstrated the establishment of mycorrhizal interactions with *S. collinitus* in the inoculated trees. Moreover, a spontaneous formation of mycorrhizal bonds with *S. collinitus* was also observed in the control (non-inoculated) trees.

Finally, recent molecular analysis of tree-roots from both plots demonstrated the establishment of spontaneous mycorrhizal interactions with native mushrooms characteristic of the pine-tree rhizosphere.

Future studies which will be based on our current findings and the tools which were developed in the this project will focus on the inoculation and planting practices needed for optimal growth and survival of young trees in dry climatic regimes and poor soils.

A historical survey of afforestation activities in Northern Israel's semi-arid zones

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Most afforestation operations in Israel are carried out over a wide range of geo-botanical habitats and in diverse and extreme climatic conditions, in rainfall areas of 100-900 mm per year. The majority of forestlands in northern Israel managed by the Keren Kayemeth Leisrael-Jewish National Fund (KKL-JNF) are characterized by natural woodlands of oaks, pistacia, carobs and other species as well as planted forests consisting mainly of various species of pines and cypresses growing on sites in the Mediterranean climatic zone. In contrast, an eastern semi-arid pocket associated with the Syrian-African Rift Valley presents challenging environmental conditions for afforestation efforts as practiced by the British Mandatory Forest Department, the Israeli Governmental Forest Department, the KKL-JNF and private entrepreneurs over the past 80 years. The accumulated experiences of planting new forests in this semi-arid zone, combined with results from introduction plots and afforestation areas throughout Israel, led to the development of a unique set of silvicultural tools and tree species employed to guarantee successful afforestation plans. All of these new afforestations function as multipurpose forestry systems

offering a wide range of ecosystem services i.e. landscape, watershed, soil conservation, pasture, recreational and non-wood forest products (NWFP) and can provide a relevant model of sustainable forest management for semi-arid and arid zones worldwide.

The history of olive cultivation in Israel

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The olive tree is of cultural, historical, environmental and religious significance for the people of Israel. Archeological and palynological evidence suggests that olives were first domesticated in this region 5,000-8,000 years ago. Hence, Israel has the longest tradition of olive cultivation as well as the oldest cultivars, which probably still exist in this region. Today, the last relicts of the wild olive populations survive in the region, and it is very important to characterize and preserve them. Moreover, the oldest olive press in the world was discovered in the Kfar Samir excavations and remains of ancient olive presses of various types and from different periods can be found throughout the country. Olives were first utilized by gathering fruits from the wild variety *Olea europaea* subsp. *europaea* var. *sylvestris*. They have been utilized by humans for millennia, mainly as an edible fruit (salted or pickled) and as a source of edible oil, which was used for cooking, as well as for soap production, lighting, and ritual ceremonies. Throughout the generations, olives were propagated by grafting superior desired clones (scions) on rootstocks, mainly saplings. In recent decades, olives are propagated mainly by scion rooting. Despite the importance of olives in local heritage, very little has been done to characterize and preserve populations of local ancient cultivars (landraces) and their wild relatives both of which are presumed to have genetic diversity that could be of great importance in a breeding program. Hence, there is a clear need for a national conservation program that would identify, characterize, and preserve local germplasm.

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Summer branch drop

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Summer branch drop is defined as the breaking and falling of tree branches during calm weather in warm seasons, commonly in the afternoon hours. This type of failure sometimes occurs in trees that exhibit visible defects, but can also occur in trees with no visible defects. Due to the lack of surveys, and of well-organized research in particular, the characteristics of this failure and the factors causing it are still far from being understood, and sometimes there are even conflicting reports and varying views on these issues. The phenomenon has almost not been studied in Israel, and there is very little information about it locally. Therefore, the objectives of this paper are to raise awareness of summer branch drop and to recommend possible preventive measures to reduce its risks. This paper presents the various approaches that deal with the characteristics and underlying causes of summer branch drop that were published in the scientific literature and in reports by various professional arboricultural associations worldwide. We also recommend preventive measures required to minimize, as much as possible, the risks posed by this phenomenon under local conditions in Israel, as well as a list of tree genera and species in which it has been documented.

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כתב מינוי

לד"ר יגיל אסם

כמדען מלווה ומנחה מקצועי
של מערך הייעור בקק"ל

ד"ר יגיל אסם מלווה למעלה מעשור את אגף הייעור בפיתוח תורת ניהול היער ובהטמעתה. הוא עושה זאת במסירות רבה, במקצועיות ומקדיש לכך זמן ניכר.

לליווי המדעי של ד"ר יגיל אסם תרומה ניכרת להתקדמות הידע היערני-אקולוגי ולפיתוח מדיניות לניהול בר-קיימא של היערות בישראל. תחומי העיסוק העיקריים של יגיל כמדען מלווה ומנחה מקצועי הם:

1. ליווי צוות ההיגוי ליישום ולהטמעה של תורת ניהול היער בישראל.
2. ייעוץ אקדמי והשתתפות בצוותי כתיבה של מסמכי מדיניות.
3. ליווי וייעוץ בבנייה וביישום מערך ניטור וסקר מצב היער החדש.
4. גיבוש מדיניות והנחיות למניעת שרפות יער.
5. מעקב אחר פעולות ממשק היער בתחומים השונים והמלצות לשיפורן.
6. סיוע במידע ובהנחיה בשאלות ממשק שונות.

מינוי זה מהווה ביטוי לצורך המקצועי בליווי מדעי צמוד בניהול היער וכן הכרה בתרומתו המיוחדת של יגיל למערך הייעור בכללותו.



גלעד אוסטרובסקי
מנהל אגף הייעור